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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 04860.P0539C2 Total Pages 3

First Named Inventor or Application Identifier Daniel S. Venolia

Express Mail Label No. EL 431 891 705 US

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, D. C. 20231

APPLICATION ELEMENTS
See MPEP chapter 600 concerning utility patent application contents.

1. X Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. X Specification (Total Pages 31)
(preferred arrangement set forth below)
- Descriptive Title of the Invention
- Cross References to Related Applications
- Statement Regarding Fed sponsored R & D
- Reference to Microfiche Appendix
- Background of the Invention
- Brief Summary of the Invention
- Brief Description of the Drawings (if filed)
- Detailed Description
- Claims
- Abstract of the Disclosure

3. X Drawings(s) (35 USC 113) (Total Sheets 10)

4. X Oath or Declaration (Total Pages 2)
   a. ___ Newly Executed (Original or Copy)
   b. X Copy from a Prior Application (37 CFR 1.63(d))
   (for Continuation/Divisional with Box 17 completed) **(Note Box 5 below)**
   i. ___ DELETIONS OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).

5. ___ Incorporation By Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ___ Microfiche Computer Program (Appendix)

7. ___ Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
   a. ___ Computer Readable Copy
   b. ___ Paper Copy (identical to computer copy)
   c. ___ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. ____ Assignment Papers (cover sheet & documents(s))
9. ____ a. 37 CFR 3.73(b) Statement (where there is an assignee)
   ____ b. Power of Attorney
10. ____ English Translation Document (if applicable)
11. _X_ a. Information Disclosure Statement (IDS)/PTO-1449
    ____ b. Copies of IDS Citations
12. _X_ Preliminary Amendment
13. _X_ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)
14. ____ a. Small Entity Statement(s)
    ____ b. Statement filed in prior application, Status still proper and desired
15. ____ Certified Copy of Priority Document(s) (if foreign priority is claimed)
16. _X_ Other: Copy of postcard with Express Mail Certificate of Mailing

17. If a **CONTINUING APPLICATION,** check appropriate box and supply the requisite information:

_X_ Continuation ____ Divisional ____ Continuation-in-part (CIP)

of prior application No: 08/104,251 filed 8-9-93; and 07/811,830 filed 12-20-91

18. **Correspondence Address**

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Connie Thayer
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4-18-00
(Date signed)

Serial/Patent No.: *** Filing/Issue Date: April 18, 2000
Client: Apple Computer, Inc.
Title: ZOOMING CONTROLLER

BSTZ File No.: 04860.P0539C2 Atty/Secty Initials: JCS/clt
Date Mailed: 4-18-00 Docket Due Date: ***

The following has been received in the U.S. Patent & Trademark Office on the date stamped hereon:

- ☐ Amendment/Response (____ pgs.)
- ☐ Appeal Brief (____ pgs.) (in triplicate)
- ☐ Application - Utility (____ pgs., with cover and abstract)
- ■ Application - Rule 1.53(b) Continuation (31 pgs.)
- ☐ Application - Rule 1.53(b) Divisional (____ pgs.)
- ☐ Application - Rule 1.53(b) CIP (____ pgs.)
- ☐ Application - Rule 1.53(d) CPA Transmittal (____ pgs.)
- ☐ Application - Design (____ pgs.)
- ☐ Application - PCT (____ pgs.)
- ☐ Application - Provisional (____ pgs.)
- ☐ Assignment and Cover Sheet
- ■ Certificate of Mailing
- ☐ Declaration & POA (____ pgs.)
- ☐ Disclosure Docs & Orig & Copy of Inventor's Signed Letter (____ pgs)
- ☐ Drawings: ____ # of sheets includes ____ figures
- ■ Express Mail No.: EL431891705US
- ☐ ____ Month(s) Extension of Time
- ■ Information Disclosure Statement & PTO-1449 (5 pgs.)
- ☐ Issue Fee Transmittal
- ☐ Notice of Appeal
- ☐ Petition for Extension of Time
- ☐ Petition for ____________
- ■ Postcard
- ☐ Power of Attorney (____ pgs.)
- ■ Preliminary Amendment (5 pgs.)
- ☐ Reply Brief (____ pgs.)
- ☐ Response to Notice of Missing Parts
- ☐ Small Entity Declaration for Indep. Inventor/Small Business
- ■ Transmittal Letter, ~~in duplicate~~ 3 pages
- ■ Fee Transmittal, in duplicate 2 pages
- ■ Check No. 33573 Amt: $690.00
- ☐ Check No. ______ Amt: ______

■ Other: copy of prior appln serial no. 08/104,251 filed8-9-93 (31pgs) with signed Declaration (2 pages) and drawings (10 sheets); IDS under 1.98(d).

Docket No: 04860.P0539C2 Patent

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Daniel S. Venolia Application No.: _______ Filing Date: April 18, 2000 For: ZOOMING CONTROLLER	Examiner: J. Brier Art Unit: 2775

Asst. Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Preliminary to examination of the present application, please enter the following amendment.

IN THE SPECIFICATION

On line 1, page 2, please add the following:

--This application is a continuation of co-pending U.S. Patent Application Serial No. 08/104,251, filed August 9, 1993, which is now U.S. Patent No. ______, which is a continuation of U.S. Patent Application Serial No. 07/811,830, filed December 20, 1991, which is now abandoned.--

IN THE CLAIMS

Please cancel claims 1-25 and add the following new claims:

26. (New) A method of implementing a single input device for controlling movement of a cursor displayed on a data processing system and for controlling access of a particular piece of data within a data field displayed by the data processing system, said method comprising:

positioning a moveable cursor to a location on a display screen in response to movement with said input device when a signal supplied by said input device is in a first state;

when said signal is in a second state, remapping control of said input device, wherein movement with said input device controls both a resolution and a range of said data field for display on said display screen;

selectively varying said resolution at which said data field is displayed responsive to movement with said input device in a first axis, wherein movement with said input device in said first axis changes said resolution;

controlling said range of the data field for display in response to movement with the input device in a second axis, wherein movement in the second axis causes different ranges of the data field to be displayed;

moving the input device in the first and second axes to simultaneously vary said resolution and said range of display, until the particular piece of data is accessed.

27. (New) A method as defined by Claim 26 wherein said input device is comprised of a mouse and the resolution is controlled by moving said mouse in the first axis and the range is controlled by moving the mouse in the second axis.

28. (New) A method as defined by Claim 26 wherein said input device is comprised of a trackball and the resolution is controlled by moving said trackball in the first axis and the range is controlled by moving the trackball in the second axis.

29. (New) A method as defined in Claim 26 wherein said resolution represents a scale such that a change in resolution corresponds to a change in scale of data in said data field.

30. (New) A machine readable medium which stores executable program instructions which when executed cause a digital processing system to perform a method of implementing a single input device for controlling movement of a cursor displayed by the digital processing system and for controlling access of a particular piece of data within a data field displayed by the digital processing system, said method comprising:

positioning a moveable cursor to a location on a display screen in response to movement with said input device when a signal supplied by said input device is in a first state;

when said signal is in a second state, remapping control of said input device, wherein movement with said input device controls both a resolution and a range of said data field for display on said display screen;

selectively varying said resolution at which said data field is displayed responsive to movement with said input device in a first axis, wherein movement with said input device in said first axis changes said resolution;

controlling said range of the data field for display in response to movement with the input device in a second axis, wherein movement in the second axis causes different ranges of the data field to be displayed;

moving the input device in the first and second axes to simultaneously vary said resolution and said range of display, until the particular piece of data is accessed.

31. (New) A machine readable medium as in Claim 30 wherein said input device is comprised of a mouse and the resolution is controlled by moving said mouse in the first axis and the range is controlled by moving the mouse in the second axis.

32. (New) A machine readable medium as in Claim 30 wherein said input device is comprised of a trackball and the resolution is controlled by moving said trackball in the first axis and the range is controlled by moving the trackball in the second axis.

33. (New) A machine readable medium as in Claim 30 wherein said resolution represents a scale such that a change in resolution corresponds to a change in scale of data in said data field.

REMARKS

The foregoing new claims are based upon allowed claim 12 from the parent patent, and the undersigned has explained the bases for these claims to Examiner Brier. No new matter has been added to the application, and the Applicant believes that these new claims are allowable at least for similar reasons that claims in the parent application were allowed.

If the Examiner has any questions or comments, Applicant respectfully requests that the Examiner contact the undersigned by telephone.

Please charge any shortages or credit any overages to Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN

Date: 4/18, 2000

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4-18-00
(Date signed)

UNITED STATES PATENT APPLICATION

for

ZOOMING CONTROLLER

Inventor

Daniel S. Venolia

Prepared By:

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FIELD OF THE INVENTION

The present invention pertains to the field of computer systems. In particular, the present invention relates to a method and device enabling a computer system to access a data field having a broad range and a fine resolution.

BACKGROUND OF THE INVENTION

Many types of data have a broad range and a fine resolution. For example, a videodisk is composed of a continuum of frames. The video disk can store up to a series of tens of thousands of frames. Thus, it has approximately five orders of magnitude. Likewise, electronic music composition requires controlling frequencies over the entire audible scale ranging from 15 to 20,000 hertz. Thus, three orders of magnitude are required to cover this range. Similarly, a five second digital audio clip may require five orders of magnitude to access each bit sample. These types of data are often linear in the sense that there are starting and ending points and many linked "frames" of data between the starting and ending points.

In order to access a videodisk, one needs frame accurate control over the entire medium. In other words, a user must be able to readily pick out one particular desired frame nestled among tens of thousands of frames. It becomes readily apparent that tasks such as adjusting key frames in an video film or manipulating audio samples, can be quite time consuming and frustrating. What is needed is a method or apparatus which lets the user find and access one particular desired piece of data which is located among a broad range of data.

In the past, this was accomplished by using scroll bars. However, scroll bars typically can handle only two orders of magnitude. Consequently, a scroll bar would need to be approximately twenty yards long in order to grant access to each frame of a video disk. This is impracticable.

Another method used in the prior art was to implement VCR-type controls. This allows the user control over the entire range of data. However, these types of controls lack selectivity. For example, it would be difficult for a user to stop precisely on one particular desired frame of a VCR tape. The user would probably either overshoot or undershoot the desired frame and would probably go back and forth searching for that particular frame. What is needed is a method that gives the user control over a broad range, while giving the user random access to any particular piece of data within that range, especially at fine resolutions.

Yet another method used in the prior art to solve this problem is to provide one control for magnification of the data and another control for scanning at the selected magnification. One product utilizing this technique is SoundEdit™ by Farallon Computing, Inc. However, this implementation has a drawback in that it requires two separate controls. A further disadvantage is that these two controls cannot be operated simultaneously. A user has to change the magnification control independently from the navigation control. Such a system results in wasted time and effort. Thus, what is needed is a method for providing the user with easy and fluid interaction over varying magnification scales while simultaneously providing the user with the capability of scanning at that magnification scale.

SUMMARY AND OBJECTS OF THE INVENTION

In view of the problems associated with providing a user with control over a broad range of data, particularly linear data, one objective of the present invention is to provide the user with access of data down to very fine resolutions in a simple, natural, and cost effective method by utilizing a cursor positioning device such as a mouse, a trackball, touch tablet, joystick or other input device having the capability of providing control for movement in 2 dimensions (2 degrees of freedom) of a cursor.

Another objective is to increase the speed, accuracy, and selectivity of accessing data over a broad range by providing the user with easy and fluid interaction over varying magnification scales, while simultaneously providing the user with the capability of scanning the data at that magnification scale.

A method and device for accessing a broad data field having a fine resolution is described. The user selects a scale which can be varied by the user. The scale controls the magnification at which the user accesses and/or examines the data, and it may be considered that a selected magnification provides a particular range of the data (from one point to another point in the data). By moving the range to encompass different portions of the data field, the user can scan that portion of the data field. The present invention allows the user to simultaneously select the scale while moving the range over different portions of the data field. Thus, the user can "zoom in" and "zoom out" of different portions of the data field.

In one embodiment of the present invention, a particular piece of data within the broad data field can be accessed. First, the scale is selectively varied, thereby controlling a range within the data field. Then, the range is moved to encompass portions of the data field in which the piece of data resides. Next, the scale is successively decreased while, simultaneously, points successively closer to the location are kept with the range. The scale is decreased which increases the magnification (i.e., increasing the range's

resolution). The range is moved in this manner until the piece of data is actually accessed.

This is accomplished by using an input device having two degrees of freedom (e.g., a mouse, trackball, touch tablet, joystick, etc.). These two degrees of freedom can be provided by movement along two different axes. For example, movement can be along the x and y-axes in a Cartesian coordinate system. Movement along one axis controls the selection of the scale, while movement along the other axis controls the particular range at that scale. In preferred embodiment, these axes can be remapped to control the position of a cursor on a display screen, instead of the scale and range. In other words, the same input device can control either the position of a cursor or control the scale and range, simply by remapping the axes of the input device.

Other objects, features, and advantages of the present invention will be apparent from the accompanying drawings and from the detailed description that follows below.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

Figure 1 shows an example of the reduction of a full sized textual document for one embodiment of the present invention.

Figure 2 shows an example of one embodiment of the present invention for accessing a name from a phone book.

Figure 3 is a block diagram of the computer system upon which the present invention may be implemented.

Figure 4 is a block diagram of one embodiment wherein a mouse is utilized.

Figure 5 is a screen shot of the Zooming History Controller display.

Figure 6 are a series of screen shots of the Zooming History Controller display at various time scales ranging from decades to seconds.

Figure 7 depicts the auto-scrolling of the Zooming History Controller's timeline (allowing movement at a particular magnification through the data) and scale slider (allowing modification of the magnification at which the data can be scanned).

Figure 8 depicts auto-scrolling the Zooming History Controller's timeline.

Figure 9 depicts the Zooming History Controller's timeline when the user scrolls the timeline rapidly.

Figure 10 shows an alternate embodiment of the present invention as applied to videodisks, the Zooming Videodisk Controller.

DETAILED DESCRIPTION

A method and apparatus for providing the user with easy and fluid interaction over varying magnification scales, while simultaneously providing the user with the capability of scanning at that scale is described. In the following description, the present invention is implemented in reference to a Zooming History Controller and a Zooming Videodisk Controller.

It will be obvious, however, to one skilled in the art that the present invention can equally be applied to other implementations, as well. The present invention can be used in conjunction with editing textual documents. This invention enhances the user's ability to view a textual document at any point in its creation history by enabling the user to control the historical view of a document that may have been around for years and modified on a time scale of seconds. Thus, the present invention enhances the control of a document by showing the state of the document as it appeared at a selected time. Thus, the various edits to a document over time may be viewed; in other words, the document may be viewed at various stages of its creation such as a first draft, a second draft, etc.

On the other hand, the present invention can be used to graphically reduce a document. By using the structure implicit in the document, a more semantically valid zoom can be achieved. Outlines can progressively collapse the most-indented items, showing just structure and spacing. Figure 1 shows the reduction of one page of a full sized textual document. The sequence of steps for a textual document as it is zoomed out are: squeezing out white space, squashing all but the first lines of each paragraph, eliminating all but the first lines, eliminating all body text while leaving headings and sub-headings, then eliminating subheads, leaving headings only. Similarly, computer programs may also be edited in this manner.

The present invention also enhances accessing any collection of items that has an order, such as a data set having a linked collection of items. For example, one embodiment is to access a phone directory as shown in Figure 2. Initially, twenty names at regular intervals from A to Z are displayed. An indicator portrayed as a triangle with an attached horizontal line, can slide up

and down this list. The user can implement another control to zoom in and out of this list. For example, as the user zoomed in on Collins, the display would show names sampled over A to N, then from B to D, then only the C's, and so on. The desired name is selected by moving the indicator while zooming in on the desired name. Similarly, in another embodiment, the present invention can be used as a dictionary. The user starts with the most frequently used words and then "zooms in" on successively less frequently used words.

Another embodiment of this invention is to adjust a purely abstract number for a frequency of a music synthesizer, simulation variable, etc. Horizontal mouse movement would choose the digit that is incremented or decremented by vertical mouse motion. Along these same lines, the present invention can also be applied to adjusting key frames in a video film or manipulating audio samples.

Referring to Figure 3, the computer system upon which the preferred embodiment of the present invention is implemented is shown as 100. 100 comprises a bus or other communication means 101 for communicating information, and a processing means 102 coupled with bus 101 for processing information. System 100 further comprises a random access memory (RAM) or other dynamic storage device 104 (referred to as main memory), coupled to bus 101 for storing information and instructions to be executed by processor 102. Main memory 104 also may be used for storing temporary variables or other intermediate information during execution of instructions by processor 102. Computer system 100 also comprises a read only memory (ROM) and/or other static storage device 106 coupled to bus 101 for storing static information and instructions for processor 102, and a data storage device 107 such as a magnetic disk or optical disk and its corresponding disk drive. Data storage device 107 is coupled to bus 101 for storing information and instructions. Computer system 100 may further be coupled to a display device 121, such as a cathode ray tube (CRT) coupled to bus 101 for displaying information to a computer user. An alphanumeric input device 122, including alphanumeric and other keys, may also be coupled to bus 101 for communicating

information and command selections to processor 102. An additional user input device is cursor control 123, such as a mouse, a trackball, or cursor direction keys, coupled to bus 101 for communicating direction information and command selections to processor 102, and for controlling cursor movement on display 121. This input device typically has two degrees of freedom in two axes, a first axis (e.g. x) and a second axis (e.g. y), which allows the device to specify any position in a plane. Another device which may be coupled to bus 101 is hard copy device 124 which may be used for printing instructions, data, or other information on a medium such as paper, film, or similar types of media. Lastly, computer system 100 may be coupled to a device for sound recording and/or playback 125 such an audio digitizer means coupled to a microphone for recording information. Further, the device may include a speaker which is coupled to a digital to analog (D/A) converter for playing back the digitized sounds.

In the currently preferred embodiment, computer system 100 is one of the Macintosh® family of personal computers such as the Macintosh® II manufactured by Apple® Computer, Inc. of Cupertino, California (Apple and Macintosh are registered trademarks of Apple Computer, Inc.). Processor 102 is one of the 68000 families of microprocessors, such as the 68000, 68020, or 68030 manufactured by Motorola, Inc. of Schaumburg, Illinois.

Mouse Control for the Present Invention

In one preferred embodiment of the present invention, a mouse is used. Figure 4 is a block diagram showing this embodiment. A mouse 130 is a small hand-held box-like device which is coupled to the computer system 100 by a cable. A sensing mechanism 132 monitors the magnitude and direction of movement of mouse 130 and generates an output signal based thereon. This signal is sent to computer 100 for processing. After processing, computer 100 sends a signal to display device 121, which can effect a change in the display corresponding to the mouse's movements. One or more push-down button(s) 131 are provided on the mouse 130. By depressing button(s) 131, a signal is sent to computer 100 that a desired location on display device

121 has been selected. The combination of moving mouse 130 to point a cursor to an object on the display screen and pressing the button(s) 131, while the cursor is pointing to the object to select the object, is called "point and click." An example of such a mouse can be found in U.S. Patent Number Re. 32,632.

In the currently preferred embodiment, the mouse not only controls a cursor position on a display screen, but it can also be made to control two different parameters. The way in which this is accomplished is by "remapping" the mouse's axes from controlling the x and y-axes cursor movements to, instead, controlling two parameters. When an axis of the mouse is remapped to a parameter, motion in that axis no longer moves the cursor. Instead, it controls the parameter.

By disassociating the axis of the mouse from the cursor, the mouse movement is not constrained by the edges of the display screen. Typically, when the cursor is positioned at the edge of a display screen, further movement of the mouse in the direction towards that edge will not effect any changes in the cursor position. With the present invention, when the axes of the mouse is remapped to controlling two parameters instead of the cursor position, the mouse may be moved in a range corresponding to the range of the two parameters rather than a range constrained by the boundaries of a display screen. In short, the present invention allows an input device with two degrees of freedom such as a mouse, trackball, touch pad, joystick, etc. to remap its axes to controlling two or more different sets of parameters.

However, it can be disconcerting to users to see the cursor remaining stationary while the mouse is moving. To overcome this, the cursor is hidden whenever either axis of the mouse is being remapped. The cursor reappears when the mouse control is shifted back to controlling the cursor position.

With the cursor hidden, one problem is that visual feedback for motion in the remapped axis is reduced. This makes that axis parameter somewhat harder to control. In an alternative embodiment, this problem is minimized by ignoring the mouse's motion in the remapped axis, unless it is

the dominant axis. The dominant axis is defined as being the axis that has been moved the most. Thus, only the parameter associated with the dominant axis is affected by the mouse's movements.

In one alternative embodiment, while an axis of the mouse is remapped, motion in that axis is not remapped, so the cursor retains its original position, until the mouse control is shifted back again to controlling the cursor. When both axes of the mouse are remapped to control two different parameters, the elements corresponding to those parameters will be highlighted as the parameters values change. When the mouse control is returned to controlling the cursor position, the cursor reappears over the last element affected.

The use of the mouse as a parameter control can also be supplemented by consistent visual reinforcement. For example, various icons can be used as indicators, pointers, and scrollers and various symbols may be used to represent certain aspects of the parameters being controlled.

Some parameters need an approximate setting. Others demand a more precise value. When controlling a remapped approximate parameter, each unit of motion of the mouse (~ one hundredth of an inch for the Macintosh™ mouse) can effect a change in the value of the parameter. For values that need to be controlled more precisely, one preferred embodiment is to reduce the mouse's motion units by eight times. Otherwise, the mouse's movements become too sensitive.

When values are assigned to parameters, the preferred embodiment is to make the mouse axes consistent with a positive or a negative change in that parameter's value. In other words, if a slider, scroll bar, or other graphic widget is used to represent the value that the mouse is controlling, the mouse axes are remapped to the dominant graphic axes. For example, if the slider is graphically oriented vertically, upward motion of the mouse moves the slider knob up. If a parameter value has no graphic representation in the system, a standard is applied consistently. One embodiment of this concept is to define rightward and upward movement to be "more" and leftward and downward to be "less".

In the preferred embodiment of the present invention, one parameter corresponds to a scale and the other parameter corresponds to an increment within the scale's range. The mouse is used to allow a user to simultaneously adjust both the control of the time scale and the control for scanning at the selected time scale. This is accomplished by reassigning the axes of the mouse from moving the cursor to controlling the time scale and the selected value at that time scale. By depressing the mouse button while the cursor is positioned over certain interface elements, the mouse is disengaged from the cursor. Instead, vertical movement of the mouse adjusts the time scale and horizontal mouse movement adjusts the selected value at that time scale. These parameters and their control will be explained in greater detail below.

<u>The Preferred Embodiment - Zooming History Controller</u>

The present invention as applied to the Zooming History Controller enables the user to browse the time domain at any time scale (magnification) or choose an incremental time value by successive refinement. The Zooming History Controller zooms on a time continuum for picking a date/time. This is accomplished by utilizing a mouse in the manner described above.

Figure 5 shows the Zooming History Controller "© Apple Computer, Incorporated". Basically, the user controls two values: the time scale and the selected time within that time scale. The time scale is controlled and shown by scale slider 11. Scale slider 11 also gives the current scale of timeline 14. The selected time is shown both in the column of fields 12 and by the indicator 13 on timeline 14.

Scale slider 11 is comprised of a vertical bar 15, a control knob 16, and arrow icons 17 and 18. By using the mouse or other cursor positioning means to position the cursor on vertical bar 15 and clicking the mouse button, control knob 16 highlights and repositions itself to the cursor location. If the cursor is positioned over control knob 16 and the mouse button is depressed and kept depressed, control knob 16 will track the vertical movements of the mouse by sliding up and down vertical bar 15 as the mouse is dragged up and down. Control knob 16 will continue to track the vertical mouse movements

until the mouse button is released. All the while that control knob 16 is being moved, the scale of timeline 14 is also correspondingly increased or decreased according to the vertical position of control knob 16.

Scale slider 11 can also be controlled by disassociating the mouse from the cursor and moving the mouse in a vertical motion. If the cursor is positioned over timeline 14 and the mouse button is depressed and kept depressed, control knob 16 will be highlighted and will move correspondingly to the vertical movement of the mouse. As control knob 16 slides up vertical bar 15, the scale of timeline 14 increases (i.e., the amount of time covered by the timeline increases), thereby decreasing the resolution of timeline 14. In other words, the magnification at which one observes the data (timeline) decreases. Conversely, as control knob 16 slides down vertical bar 15, the scale of timeline decreases (i.e., the amount of time covered by the timeline decreases), thereby increasing the resolution of timeline 14. As the scale of timeline 14 changes, so too is the appearance of the timeline altered to reflect the new scale.

Also, as control knob 16 moves up vertical bar 15, arrow icon 17 is highlighted. Arrow icon 17 resides at the top of vertical bar 11 and points straight up. As control knob moves down vertical bar 15, arrow icon 18 is highlighted. Arrow icon 18 resides at the bottom of vertical bar 15 and points straight down. The mouse's movements correspond to changes on the display screen in units of pixels. However, each pixel unit changes the scale value so slightly that control knob 16 might not move at all or might not appear to move. By highlighting arrow icons 17 and 18, the association between the mouse movement and the changes in scale is enhanced.

When the user releases the mouse button, the highlights and arrow markers disappear, and the cursor reappears. Even if the mouse had been moved vertically, the cursor reappears at the vertical position that it had when the mouse button was first depressed. While the mouse button was depressed, its vertical axis was decoupled from the cursor, and attached instead to controlling the scale.

Figure 6 shows screen shots 25-30 of timeline 14 at various scales ranging from decades to seconds. The selected time is shown by the column of fields 12. The column of fields 12 is divided into rows 19-24, corresponding to convenient time fields, shown on the left-hand side, and the selected time units, shown on the right-hand side. Row 19 gives the year field (Year) and the selected year unit (1975). Row 20 gives the month field (Month) and the selected month unit (Jan). Row 21 gives the day field (Day) and the selected day unit (17th). Row 22 gives the hour field (Hour) and the selected hour unit (11 am). Row 23 gives the minute field (Minute) and the selected minute unit (:05). Row 24 gives the seconds field (Second) and the selected second unit (:13). Thus, the selected time in figure 3 is 13 seconds past 11:05 am of January 17, 1975.

It can be seen from screen shots 25-30 that timeline 14 looks different for different time scales, even though they represent the same selected time (i.e., 11:05:03 am January 17, 1975). Screen shot 25 depicts timeline 14 wherein the scale is in years. The selected field is depicted by shading the correct row 19-24 which corresponds to that particular scale. In screen shot 25, since the year field was selected, row 19 which corresponds to the year field, is shaded. The selected year, "1975", is shown on the right-hand side of row 19. Similarly, screen shot 26 depicts timeline 14 wherein the scale is in months. Accordingly, row 20 which corresponds to the month field, is shaded. Likewise, screen shots 27-30 depict timeline 14 wherein the scale is in days, hours, minutes, and seconds, respectively.

It can be seen from screen shots 25-30 of Figure 6 that as the scale is decreased, the resolution of timeline 14 is increased. Screen shot 25 shows the scale in years. Timeline 14 gives a range of approximately a decade. This allows the user to select a time to a resolution of years. Screen shot 26 shows the scale in months. Its timeline gives a range of approximately two years. This allows the user to select a time to a resolution of months instead of years. As the scale is decreased, the resolution increases. Screen shot 30 shows the scale in seconds. The range of timeline 14 for screen shot 30 covers a range of approximately 15 seconds. This allows the user to select a time to a

resolution of seconds. Thus, by simulating controlling the scale and value of the timeline, this embodiment allows the user to select a particular time, within seconds, from a range of a century.

The fields and the selected times are highlighted up to the current finest-resolved selected time. Finer scales and units are dim, in comparison. This is illustrated in Figure 6. In screen shot 25, the selected scale is in years and the corresponding selected time unit is 1975. Thus, for that resolution, the "Year" field and the "1975" time unit are highlighted. As the resolution increases, as in screen shot 28, it can be seen that the prior selected fields (i.e., "Year", "Month", and "Day") and selected time units ("1975", "Jan", and "17th") remain highlighted. The current selected field ("Hour") and the current selected time unit ("11 am") are also highlighted. Yet the finer fields ("Minute" and "Second") and time units (":05 :" and ":13") which have yet to be selected by the user, remain dimmed.

As shown in Figure 6, indicator 13 includes an icon and a vertical line segment. The icon for indicator 13 resides halfway along the top of timeline 14. The vertical line segment extends from the bottom of the indicator icon, through timeline 14, to the bottom edge of timeline 14. The line segment intersects timeline 14 which corresponds to the selected time (also displayed by the column of fields 12). As the scale is changed, the icon representing the indicator also changes to reflect the change in the scale. For example, the indicator icon representing the year scale, is in the shape of an hourglass, as shown in screen shot 25. The icon representing indicator 13 changes to the shape of a calender for time scales of months and days, as shown in screen shots 26 and 27, respectively. The icon representing indicator 13 changes to the shape of a clock for time scales of hours and minutes , as shown in screen shots 28 and 29, respectively. The icon representing indicator 13 changes to the shape of a stopwatch for the time scale of seconds.

Once the desired field has been selected, the user may then select any time unit within that field. For example, in screen shot 26 of Figure 6, since the user has selected the month scale, the user may now select time units corresponding to months of the year (e.g., Jan. - Dec.). This is accomplished by

moving the mouse horizontally. (Remember that the scale was controlled by moving the mouse vertically.) Horizontal movement of the mouse controls the timeline and thus the position of access into the data at the selected scale/magnification.

Furthermore, once a desired field has been selected, the scale can, nevertheless, be changed within that field. For example, in screen shot 25 of Figure 6, even though the selected field is "Years", the user may change the scale of timeline 14 so long as what is displayed remains in years. Thus, timeline 14 may have an enlarged scale such that a decade is shown or may have a reduced scale such that only half a dozen years are shown. Likewise, in screen shot 27, given the same field ("Day"), timeline 14 may have a scale encompassing 12 days (as shown) or may have a reduced scale encompassing only a couple of days.

Figure 7 shows the manipulation of the timeline. The timeline is manipulated by using the mouse to position the cursor over some point of timeline 14. When the mouse button is then "clicked", indicator 13 is repositioned to where the cursor is located. Indicator 13 and control knob 16 are highlighted. Arrows 17 and 18 appear above and below vertical bar 15 of scale slider 11. In addition, the cursor is removed from the display screen so that it is no longer displayed.

As the mouse is moved horizontally to the left and right, while still keeping the mouse button depressed, indicator 13 tracks the mouse's movements. In other words, indicator 13 (i.e., the icon and the vertical line segment) moves horizontally, left and right, across the width of timeline 14 to track the mouse's movements.

When the indicator is moved horizontally, it is constrained to stay within the boundaries of the timeline. If the indicator is moved to either the right or left ends of the timeline, an arrow symbol appears. Figure 8 shows the situation wherein indicator 13 is moved towards the left end of timeline 14. When indicator 13 reaches the left-most edge of timeline 14, arrow symbol 31 appears to the left of indicator 13 and points leftward. Similarly, if

the indicator is moved to the right-most edge of the timeline, an arrow symbol pointing to the right will appear to the right of the indicator.

When the indicator is moved to either edge of the timeline, in addition to the display of the arrow symbol, the timeline will scroll. The timeline will scroll to the right if the indicator is moved to the left-most edge. Conversely, the timeline will scroll to the left if the indicator is moved to the right-most edge. Thus, in Figure 6, the "8 am", "Noon", "4 pm", etc. markers and their corresponding submarkers will be scrolled to the right. New markers such as "4 am", "Midnight", "8 pm", etc. and their corresponding submarkers will successively appear from the left and be progressively scrolled to the right.

Furthermore, if the mouse is moved to the right or left, beyond the extremes of the timeline, the rate of the scrolling will increase. In addition, the arrow symbol will become longer. The farther that the mouse is moved beyond the timeline extremes, the faster the scrolling rate and the longer the arrow symbol become. Figure 7 shows the situation wherein the mouse is moved to the left, beyond the left-most edge of timeline 14. It can be seen that indicator 13 is constrained within timeline 14. As the mouse is moved beyond that point, arrow symbol 31 becomes longer and timeline 14 is scrolled faster as shown in Figure 9.

The timeline may also be scrolled without moving the indicator. This is accomplished by using two arrow icons which are positioned on either side of the timeline. Referring back to Figure 6, it can be seen that arrow icons 32 and 33 are respectively located to the immediate left and right of timeline 14. Arrow icon 32 points to the left, and arrow icon 33 points to the right. If the user positions the cursor over one of these two arrow icons, depresses the mouse button, and keeps tit depressed, several events happen simultaneously. The cursor disappears, the selected arrow icon is highlighted, arrow icons appear above and below scale slider 11, control knob 16 becomes highlighted, timeline 14 begins to scroll, and arrow symbols appear.

Now, vertical motion of the mouse controls the scale. Horizontal motion of the mouse controls the direction and speed of timeline 14. Moving the mouse horizontally and vertically at the same time (i.e. a diagonal movement) will simultaneously adjust the scale and the position of access to the data at the selected scale. The direction of the scroll depends on which of the two arrow icons 32 or 33 that had been selected. If arrow icon 32 was selected, then timeline 14 scrolls to the right. Conversely, if arrow icon 33 was selected, then timeline 14 scrolls to the left.

Figure 8 depicts the situation wherein the user has selected the left-pointing arrow icon 32. The more that the user moves the mouse to the left, the faster timeline 14 scrolls and left-pointing arrow symbol 31 lengthens correspondingly (as depicted in Figure 9). If the user moves the mouse to the right, the rate at which timeline 14 scrolls is reduced and the length of arrow symbol 31 shortens. Similarly, if the user had selected the right-pointing arrow icon, that icon would be highlighted. Now, the further that the mouse is moved to the right, the faster timeline 14 scrolls to the left and the right-pointing arrow symbol lengthens correspondingly. If the mouse is moves to the left, the rate at which timeline 14 scrolls is reduced and the length of the right-pointing arrow symbol shortens.

The timeline may also be scrolled by positioning the cursor on one of the fields, depressing the mouse button, and keeping it depressed. The field then becomes highlighted and the timeline's scale changes correspondingly. The cursor disappears and arrow icons appear above and below scale slider 11 and to the right and left of the selected field. As before, vertical movement changes the timeline scale. However, now the scales are limited to that particular field selected.

For example, in Figure 5, if the user selects the "Month" field 20 within the column of fields 12, timeline 14 is limited to displaying units of time in months. The user may move the mouse vertically in order to change the scale within this field in order to display more or less months. However, the user is limited to displaying time units of months. This means that the other

fields such as "Year", "Day", "Hour", "Minute", and "Second" cannot be accessed just by moving the mouse vertically.

Horizontal movement of the mouse, in this mode, scrolls timeline 14. Note that indicator 13 remains stationary. Moving the mouse to the right causes timeline 14 to scroll to the left and increments the selected time unit corresponding to that field. Moving the mouse to the left causes timeline 14 to scroll to the right and decrements the selected time unit corresponding to that field. The time units corresponding to fields that have higher resolutions than the selected field remain unchanged. Only those time units which correspond to the selected field or a lower resolution field, change according to the scrolling of the timeline.

Thus, in Figure 5, this mode allows the user to scroll timeline 14 by horizontal mouse movements. The currently selected field 20 is that of "Month", which is highlighted. The currently selected time unit is "Jul" as shown in field 20 and by indicator 13. If timeline 14 is scrolled to the right by moving the mouse to the left, the time unit would successively change to "June", "May", "April", etc. Eventually, if timeline 14 were scrolled far enough to the right, the time unit for the "Year" field 19 would change from its current "1962" to "1961". However, fields with higher resolutions (e.g., "Day" 21, "Hour" 22, "Minute" 23, and "Second" 24) than the currently selected field, along with their time units (e.g., "25th", "9 am", ":35 :", and ":04"), remain unchanged.

Figure 5 also shows arrow icons 34 and 35 straddling the selected "Month" field 20. These arrow icons appear when the user selects this mode (i.e., when the user "clicks" the cursor on a particular field). Arrow icon 34 is positioned to the immediate left of the selected field and points to the left. Arrow icon 35 is positioned to the immediate right of the selected field and points to the right. Arrow icon 34 is highlighted if timeline 14 is scrolled to the right. Arrow icon 35 is highlighted if timeline 14 is scrolled to the left.

A small bracket appears across the tip of any of the above discussed arrow icons (i.e., scale slider, timeline, or field arrow icons) if the parameter described by that arrow icon reaches an outer limit. The bracket indicates that

the parameter as represented by that icon has reached a limit and is being "blocked". The parameter remains blocked by the bracket until the parameter is pulled back from the limit.

For example, in Figure 5, if timeline 14 were constrained to not extend after the date of July 1962, a bracket 36 would appear across the tip of field arrow icon 35, if the user attempted to scroll after the date of July 1962. If timeline 14 were constrained to not extend prior to the date of July 1962, a bracket 37 would appear across the tip of field arrow icon 34, if the user attempted to scroll prior to July 1962. Another example would be if the user attempted to increase the scale to a field greater than a "Year", a bracket would appear across the tip of scale arrow icon 17.

It would be apparent to those skilled in the art that the Zooming History Controller can be linked to and access a database. Some sample databases include musical compositions, films, textual documents, etc. For example, by linking the Zooming History Controller to a musical composition, the user may easily access one particular note among thousands within the composition. This is accomplished by assigning each note to one particular incremental time unit. The user may "zoom out" to locate the general area wherein the desired note resides. The user then "zooms in" on the desired note by successively decreasing the scale (increasing the magnitude) while keeping the note within the range until the desired note is located. Thus, the user may select a desired note by "zooming in" on it in the same manner as one would "zoom in" on a particular date/time. In other words, pieces of data within a database may be sequentially linked to incremental time intervals of the Zooming History Controller. As example of this concept is described in a following section entitled "Zooming Videodisk Controller", wherein the frames of a videodisk (or film) may be easily accessed.

<u>Software Implementation</u>

In one preferred embodiment of the present invention, the Zooming History Controller is divided into two functional blocks of software code. One

block draws the contents of the Zooming History Controller based on a number of parameters. The other block changes the parameters based on the user's input. These blocks are referred to as the Draw and the Track routines, respectively.

The primary parameters to the Draw routine specify the currently selected time, the magnification, and the position of the indicator. Secondary parameters control the appearance and highlight of the various symbols and icons. This routine draws the Zooming History Controller off-screen and then copies it onto the display screen in order to minimize flashing and visual inconsistency. The primary parameters sometimes require drawing parts of the timeline that are not accessible to the user. For example, the times before and after the timeline's outer limits.

When the user "clicks" on one of the elements in the Zooming History Controller, the corresponding Track routine is invoked. Each Track routine starts by altering the mouse behavior (from controlling the cursor position to controlling the parameters) and changing the secondary parameters to make symbols and icons appear and highlight. While the mouse button is depressed, the Track routine repeatedly changes the parameters in response to mouse movement and invokes the Draw routine. The Zooming History Controller display is redrawn once more with the secondary parameters restored to normal. The mouse behavior is restored to controlling the cursor position.

A copy of a software computer code "© Apple Computer, Incorporated" for the Zooming History Controller written for the Macintosh IIfx™ computer is contained in Appendix A.

<u>An Alternative Embodiment - Zooming Videodisk Controller</u>

Figure 10 shows an alternative embodiment of the present invention as applied to videodisks, the Zooming Videodisk Controller "© Apple Computer, Incorporated". Basically, the Zooming Videodisk Controller operates in the same manner as the Zooming History Controller described above, with the following distinctions.

Similar to the Zooming History Controller, the user controls the time scale. However, in the Zooming Videodisk Controller, the user controls the selection of a video frame within that time scale, instead of a time unit.

The scale is controlled in the same manner as described in the Zooming History Controller (i.e., scale slider 39 and vertical mouse movements disassociated from the cursor). An individual frame within that scale is selected in the same manner as a particular time unit was selected in the Zooming History Controller (i.e., manipulating the timeline or moving the indicator along the timeline).

In Figure 10, timeline 36 is divided into units of time which are further subdivided into individual frames on the videodisk. Thus, the present invention enables a user to select one particular frame among thousands of frames on a videodisk. The selected time and frame is shown by the position of indicator 38 along timeline 36 and also displayed by column of fields 38. Column of fields 38 is comprised of rows 39-41. Row 39 is the "Minute" field and displays the currently selected minute in reference to the start of the videodisk. Row 40 is the "Second" field and displays the currently selected seconds in reference to the minutes. Row 41 is the "Frame" field and displays the currently selected frame in reference to the minutes and seconds. Another embodiment is to include an "Hour" row in the column of fields, in the case of longer videodisks. In Figure 9, the currently selected frame corresponds to 20 minutes, 37 seconds and 16 frames into the videodisk, "20:37:16".

The frame corresponding to the selected time/frame is pulled from the videodisk and displayed above timeline 36. This is illustrated by selected frame 37. Selected frame 37 is defined by column of fields 38 and the position of indicator 38 along timeline 36. As the user changes the selected time/frame, the corresponding frame is pulled from the videodisk and displayed.

Context frames 42 are sampled at regular intervals of the videodisk and displayed below timeline 36. Context frames 42 are displayed directly below the point of timeline 36 corresponding to their location on the timeline.

Vertical line segments connect context frames 42 to the corresponding point where they are located on timeline 36. Context frames 42 are used to give the user a reference point as to the section of the videodisk which is represented by that section of the timeline. Context frames 42 scroll in concert with timeline 36 and adjust according to the scale. If the user positions the cursor over a context frame 42 and "clicks" the mouse button, the Zooming Videodisk Controller responds in the same manner as when timeline 36 is "clicked", with one exception. When the mouse is moved horizontally, both indicator 38 and timeline 36 track the mouse's movements. In one embodiment, a graphic representation of the number of video frames between a pair of context frames 42 is shown to inform the user how much real time lies between that pair of context frames. In another embodiment, a graphic representation of the entire disk with a highlight of the timeline portion is used to inform the user what part of the video disk the current selected frame 37 resides in.

One aspect of the Zooming Videodisk Controller is that it can be used to perform functions similar to the "jog/shuttle" functions found on some high-end videotape decks. To scan over a video sequence, the user can zoom in (i.e., decrease the scale) so that the whole scene is covered in timeline 36. The user accomplishes this by adjusting the scale in reference to context frames 42. Indicator 38 is then dragged across timeline 36 to simulate the "jog" control, but at an adjustable scale.

The "shuttle" function is simulated by positioning indicator 38 to the beginning of the scene. Then, right scroll arrow icon 42 is selected via the mouse. The scene "plays" as selected frames 37 are successively displayed. The scene "plays" at the rate determined by the current scale and the current scroll speed. The scene can be "played" in reverse by selecting left scroll arrow icon 43. The user can also "freeze frame" by changing the scroll speed to zero.

A preferred embodiment of the present invention will now be described by referring to the flowchart shown in Figure 11. The first step 200 is to provide a data set (e.g., musical composition, film, textual document, etc.) to the computer system. Next, in step 201, a variable scale is provided to

the user. The y-axis of a mouse is remapped so that instead of controlling the vertical position of a cursor, vertical mouse movement controls the scale. As the scale is increased or decreased, the magnification level decreases or increases, respectively. In addition, a range is provided to display continuous portions of the data set to the user in step 202. What is depicted by the range is dependent on the scale selected. The range will span a broad portion of the data set for a large scale. However, the resolution will be low. Conversely, if the scale is reduced, the magnification level increases and narrower portions of the data set are depicted by the range. As the scale is reduced, the resolution increases. The range can be made to cover different portions of the data set for a given scale. This is accomplished by remapping the x-axis of the mouse so that instead of controlling the horizontal position of a cursor, horizontal mouse movement controls what portion of the data set is covered by the range.

In order to access a desired data point within a broad data set, the user starts in step 203 by selecting a relatively large scale. In step 204, the computer will change the span of the data set covered by the range according to the scale selected. Next, the user determines in step 205 whether the desired data point resides within the portion of the data set as depicted by the range. If so, then step 207 may be skipped. Otherwise, step 207 requires the user to move the data set relative to the range so that the desired data point resides within the portion depicted by the range. This is typically done by moving the cursor positioning device (e.g. mouse) in a horizontal direction. Afterwards, a decision must be made in step 206. Is the desired data point accessible? If the answer is "yes", then the desired data point is accessed and that is the end (step 208). If the answer is "no", then the scale must be decreased (as shown by step 209 by moving the cursor positioning device in a vertical direction) and the procedure must be repeated, starting back from step 205 until the scale is decreased enough so that the desired data point is accessible.

CLAIMS

What is claimed is:

1. A method for accessing a broad data field having fine resolution comprising:

selecting a first scale from a variable scale for controlling a magnification for accessing data within the data field;

moving the range to encompass different portions of the data field; and

changing simultaneously the scale while moving the range over different portions of the data field.

2. The method as defined by Claim 1 wherein the scale is controlled by moving a cursor positioning device along a first axis.

3. The method as defined by Claim 2 wherein the range movement is controlled by moving a cursor positioning device along a second axis.

4. The method as defined by Claim 2 wherein the range movement is controlled by moving the cursor positioning device in an axis orthogonal to the scale axis.

5. The method as defined by Claim 4 wherein moving the cursor positioning device in an upward motion increases the scale and moving the cursor positioning device in a downward motion decreases the scale.

6. The method as defined by Claim 5 wherein moving the cursor positioning device to the right causes the range to be shifted to the right and moving the mouse to the left causes the range to be shifted to the left.

7. The method as defined by Claim 6 wherein the particular piece of data can be accessed within the data field having six orders of magnitude.

8. The method as defined by Claim 7 wherein the range is depicted by a timeline.

9. The method as defined by Claim 8 wherein the cursor positioning device is also capable of controlling the position of a cursor on a display screen.

10 The method as defined by Claim 9 wherein the scale and range are capable of being controlled by positioning a cursor over an icon and depressing a button.

11. The method as defined by Claim 1 wherein the cursor positioning device is at least one of a mouse, a track ball, a touch tablet, a joystick.

12. A method for accessing a particular piece of data within a broad data field having fine resolution comprising:

selectively varying a scale, thereby determining a range, the range spanning a portion of the data field;

moving the range relative to the data field, thereby encompassing portions of the data field such that the particular piece of data lies within the range;

locating a first point close to the location of the particular piece of data;

decreasing the scale, thereby increasing the range's resolution, while simultaneously moving the range relative to the data field to keep the first point within the decreased range;

locating a second point which is closer to the location of the particular piece of data than the first point's location;

decreasing the scale while simultaneously moving the range relative to the data field to keep the second point residing within the range; and

successively decreasing the scale while scanning across the range, locating points successively closer to the location of the particular piece of data, and keeping the point that is closest to the location of the particular

piece of data within the range, until the particular piece of data is actually accessed.

13. The method as defined by Claim 12 wherein the scale is controlled by moving a mouse along an axis and the range is controlled by moving the mouse along another axis.

14. The method as defined by Claim 13 wherein the mouse is also capable of controlling the position of a cursor on a display screen.

15. The method as defined by Claim 12 wherein the scale is controlled by moving a trackball along an axis and the range movement is controlled by moving the trackball along another axis.

16. An apparatus for accessing a broad data field having fine resolution comprising:

a variable scale for controlling a range within the data field;

a means for moving the range to encompass different portions of the data field; and

a means for enabling a user to simultaneously select the scale while moving the range over different portions of the data field.

17. The apparatus as defined by Claim 16 further comprising:

a means for accessing one particular piece of data within the data field, the accessing means including:

a means for scanning data encompassed by the range corresponding to a selected scale;

a means for showing points close to the location of the particular piece of data;

a means for successively decreasing the scale, thereby decreasing the range, resulting in the increase of the range's resolution while simultaneously, locating points successively closer to the location of the

particular piece of data and keeping the closest point within the successively decreasing range, until the particular piece of data is actually accessed.

18. The apparatus as defined by Claim 17 including a switching means for switching the mouse control between controlling a cursor's position on a display screen and controlling the scale and the range.

19. The apparatus as defined by Claim 18 wherein the scale is controlled by moving a mouse along an axis and the range is controlled by moving the mouse along another axis.

20. The apparatus as defined by Claim 19 wherein rightward and upward movement of the mouse corresponds to increasing a parameter and leftward and downward mouse movement corresponds to decreasing the parameter.

21. The apparatus as defined by Claim 20 wherein the range is depicted as a timeline.

22. A method for accessing a data set containing a plurality of items comprising:

providing an input device having two degrees of freedom in a first and a second axis;

providing a means for selecting a scale of access to the data set;

providing a means for adjusting a position of access at the selected scale;

selecting the scale by controlling the input device with relation to the first axis; and

selecting the position of access by controlling the input device with relation to the second axis.

23. The method as defined by claims 22 wherein the input device is at least one of a mouse, a track ball, a touch tablet, a joystick.

24. The method as defined by Claim 23 wherein the first and the second axes of the input device are capable of being remapped such that the input device controls positioning a cursor on a display screen.

25. A method for accessing a particular piece of data within a broad data field having fine resolution comprising:

providing an input device having a first and a second degree of freedom;

providing a variable scale to depict the data field at different magnification levels, the scale being controlled by the first degree of freedom of the input device;

providing a range which encompasses a continuous portion of the data set;

selecting a scale wherein the particular piece of data lies within the range;

decreasing the scale such that the magnification level is increased;

changing the span of the data field covered by the range, according to the scale selected;

moving the data field such that the particular piece of data falls within the range, the movement controlled by the second degree of freedom; and

successively repeating the steps of decreasing the scale and moving the data field such that the particular piece of data falls within the range, until the particular piece of data is actually accessed.

ABSTRACT

A method and device for accessing a broad data field having a fine resolution. The user selects a scale which can be varied. The scale controls a range within the data field. By moving the range to encompass different portions of the data field, the user can scan that portion of the data field. The present invention allows the user to simultaneously select the scale while moving the range over different portions of the data field. Thus, the user can "zoom in" and "zoom out" of different portions of the data field.

In one embodiment of the present invention, a particular piece of data within the broad data field can be accessed. First, the scale is selectively varied, thereby controlling a range within the data field. Then, the range is moved to encompass portions of the data field in which the piece of data resides. Next, the scale is successively decreased while, simultaneously, points successively closer to the location are kept with the range. The scale is decreased (i.e., increasing the range's resolution) and the range is moved in this manner until the piece of data is actually accessed.

Figure 1

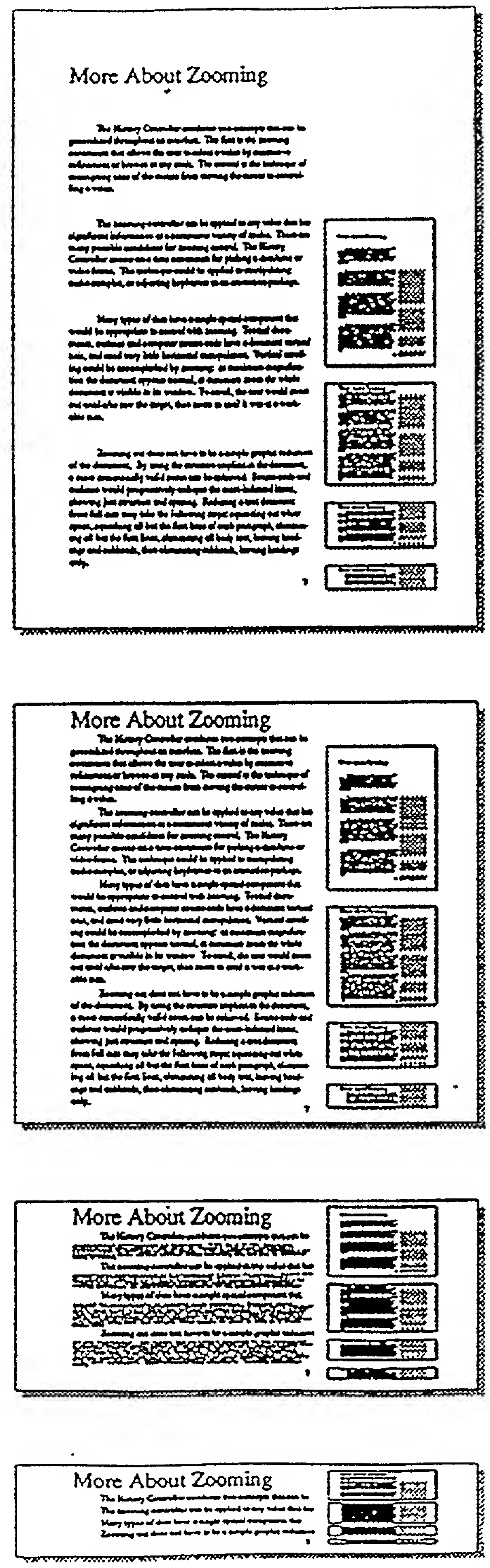
More About Zooming
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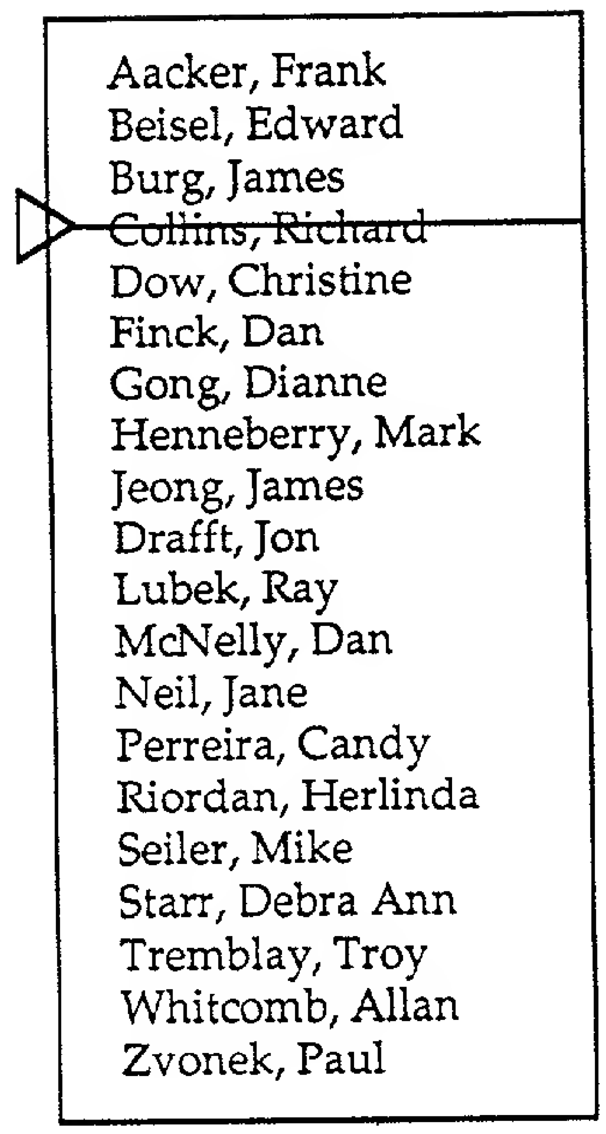
Figure 2


Aacker, Frank
Beisel, Edward
Burg, James
~~Collins, Richard~~
Dow, Christine
Finck, Dan
Gong, Dianne
Henneberry, Mark
Jeong, James
Drafft, Jon
Lubek, Ray
McNelly, Dan
Neil, Jane
Perreira, Candy
Riordan, Herlinda
Seiler, Mike
Starr, Debra Ann
Tremblay, Troy
Whitcomb, Allan
Zvonek, Paul

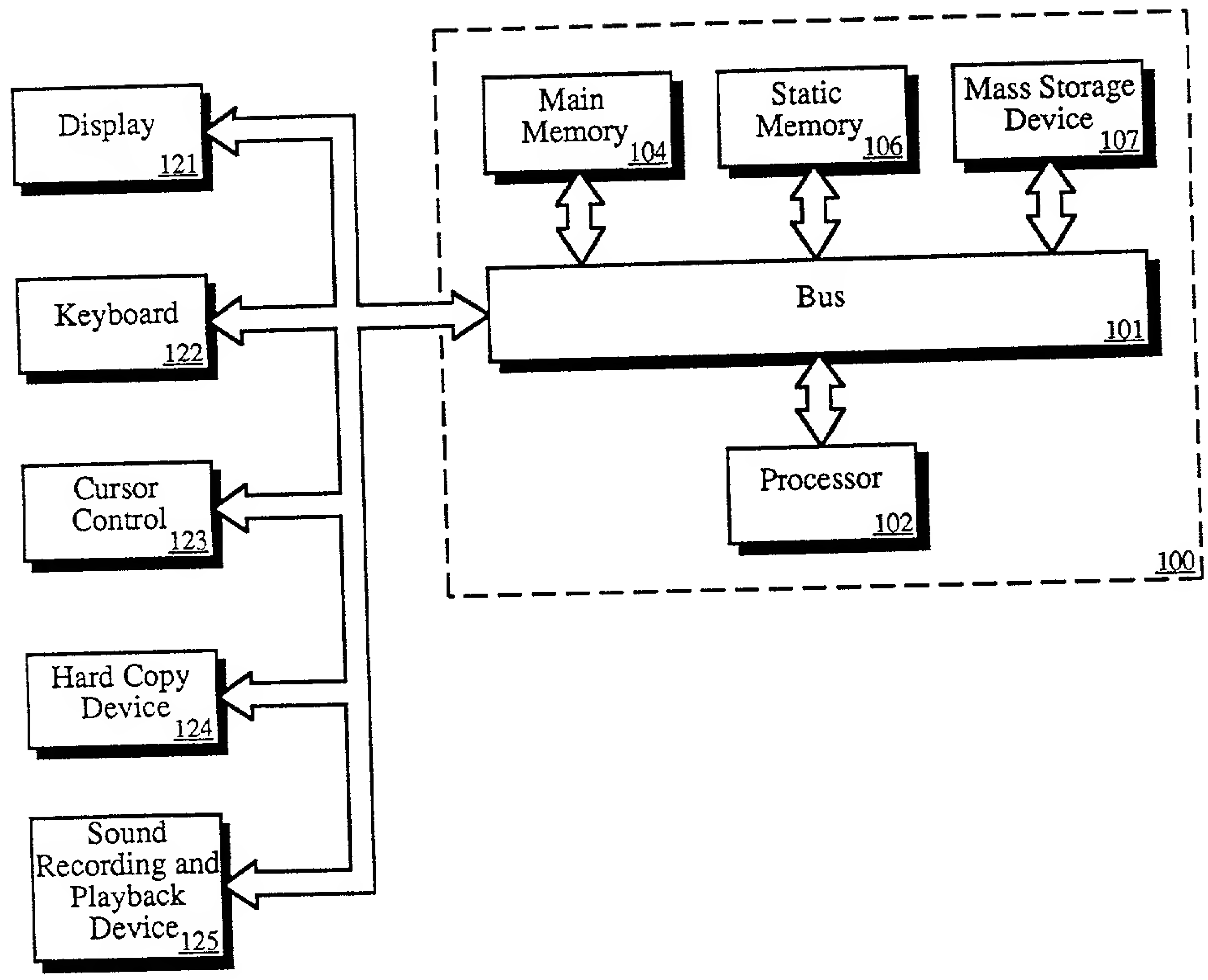

Display
121
Keyboard
122
Cursor Control
123
Hard Copy Device
124
Sound Recording and Playback Device
125
Main Memory
104
Static Memory
106
Mass Storage Device
107
Bus
101
Processor
102
100

Figure 3

Figure 4

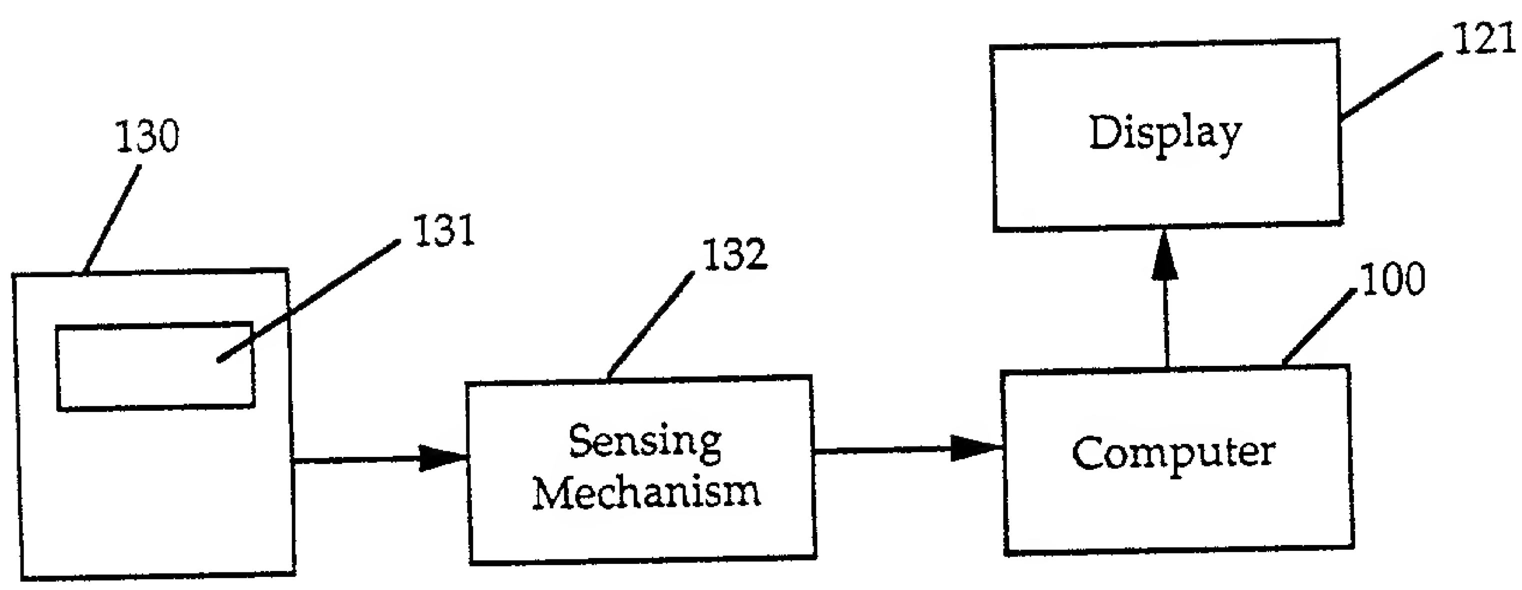
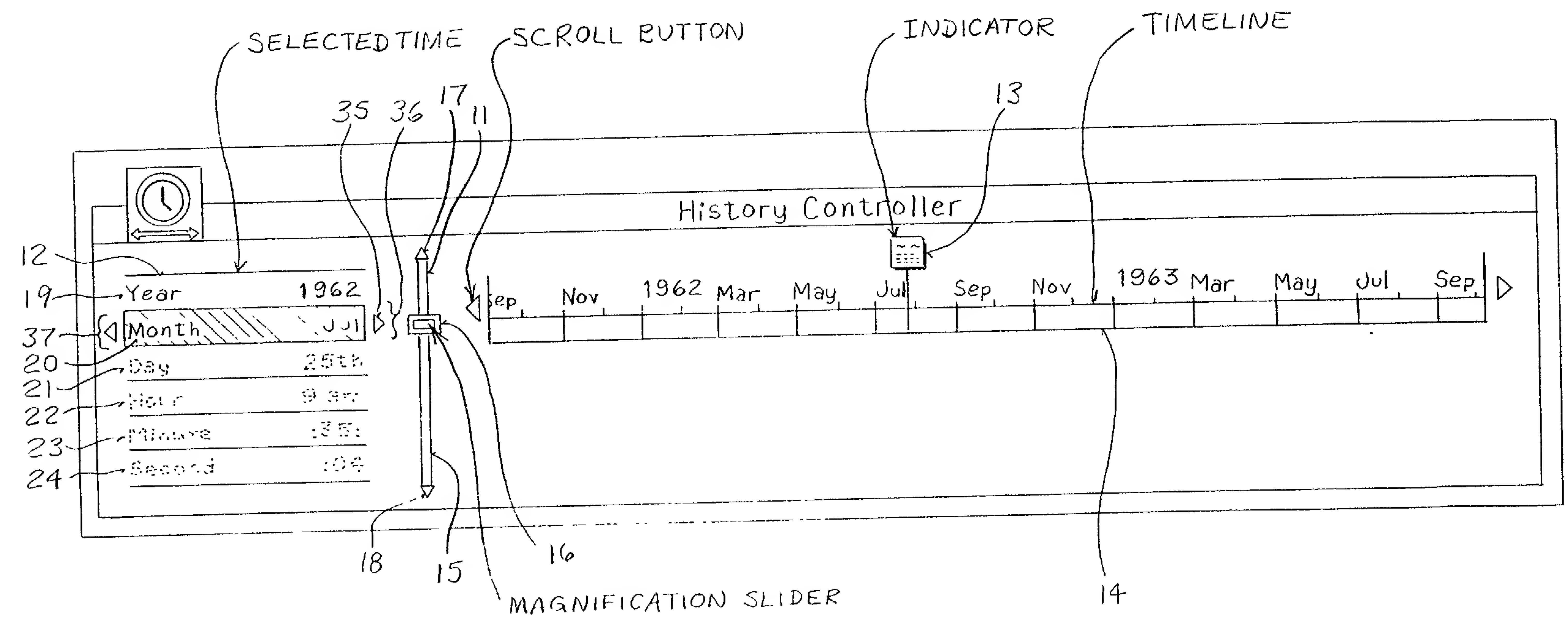
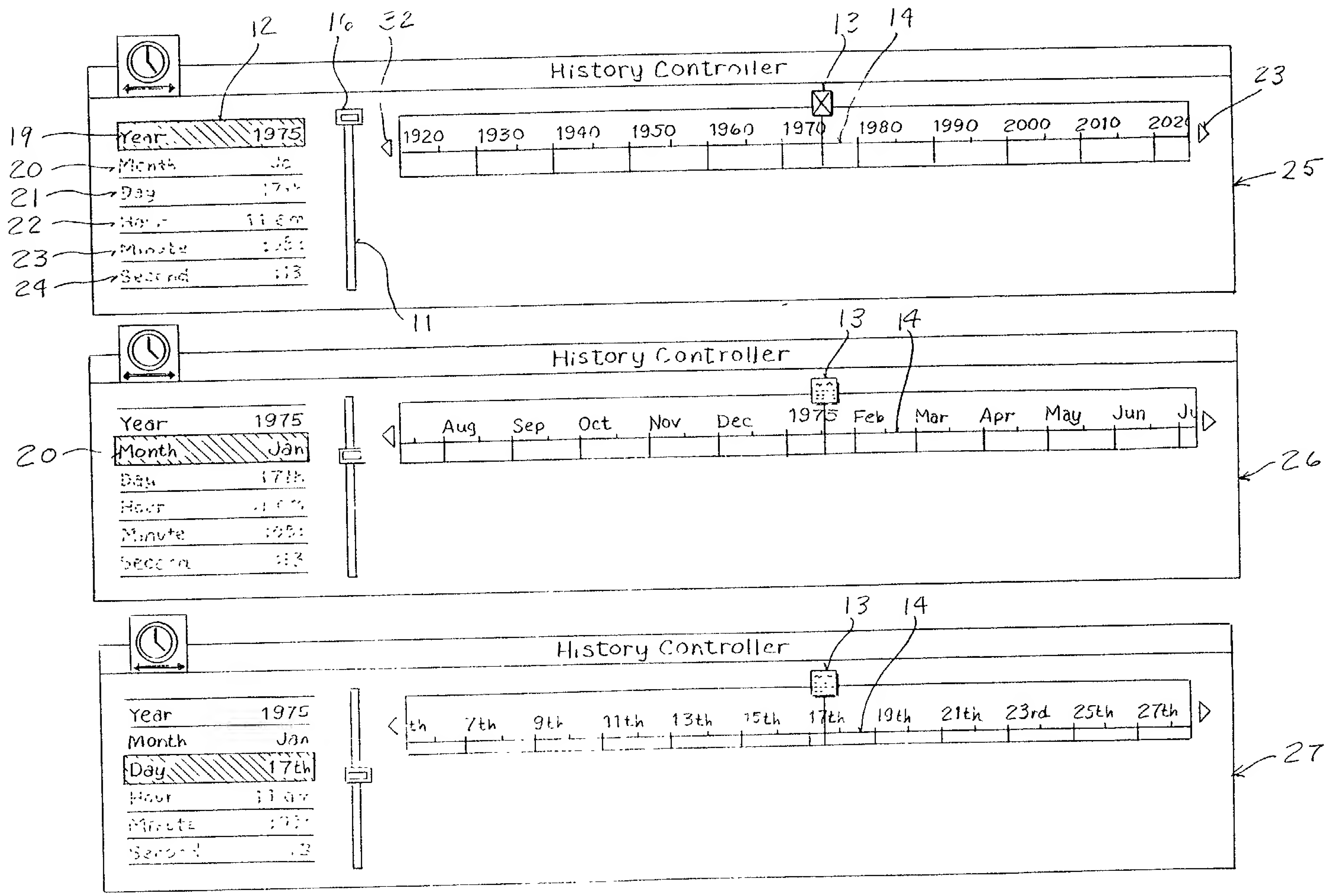


FIG. 5



09551411.041800

FIG. 1A



09551411.041800

FIG. 6B

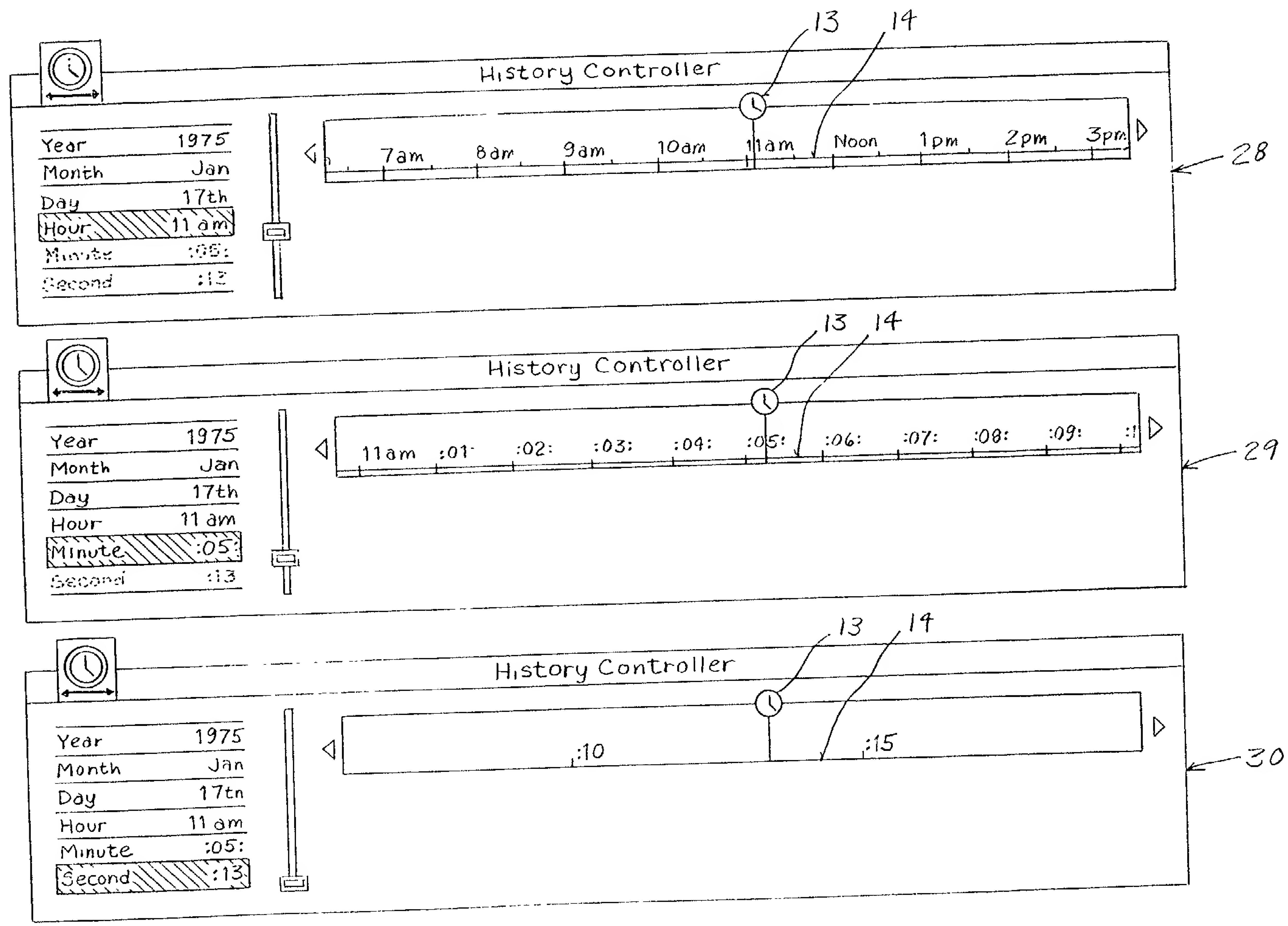

History Controller
Year 1975
Month Jan
Day 17th
Hour 11 am
Minute :05:
Second :13
7am
8am
9am
10am
11am
Noon
1pm
2pm
3pm
13
14
28
History Controller
Year 1975
Month Jan
Day 17th
Hour 11 am
Minute :05:
Second :13
11am
:01:
:02:
:03:
:04:
:05:
:06:
:07:
:08:
:09:
13
14
29
History Controller
Year 1975
Month Jan
Day 17tn
Hour 11 am
Minute :05:
Second :13
:10
:15
13
14
30

FIG. 7

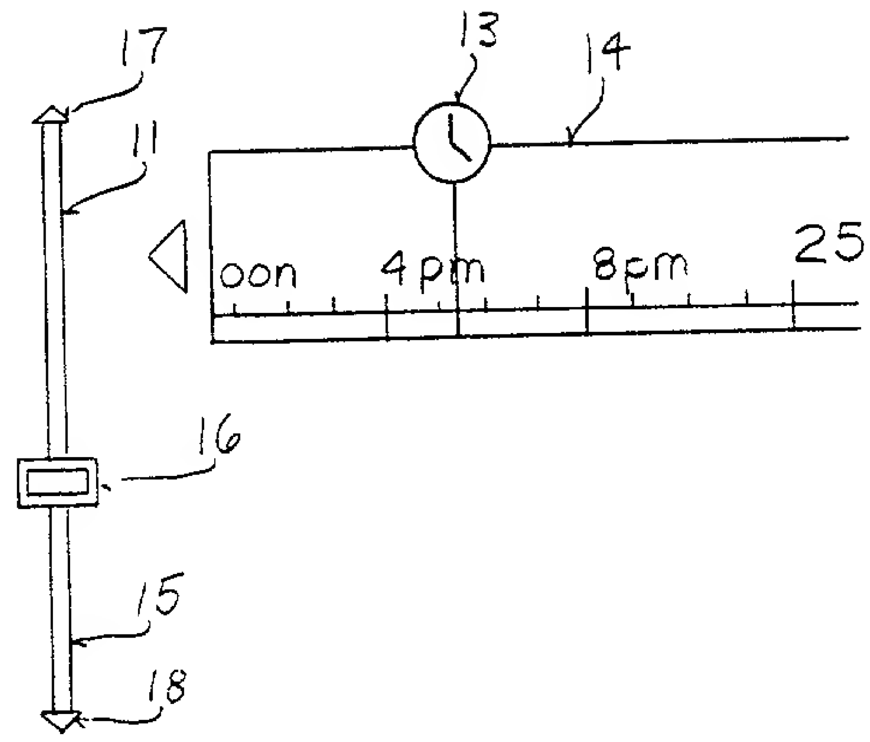


FIG. 8

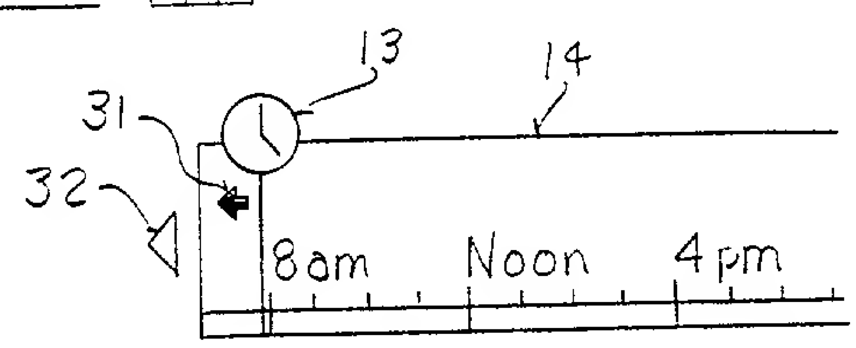


FIG. 9

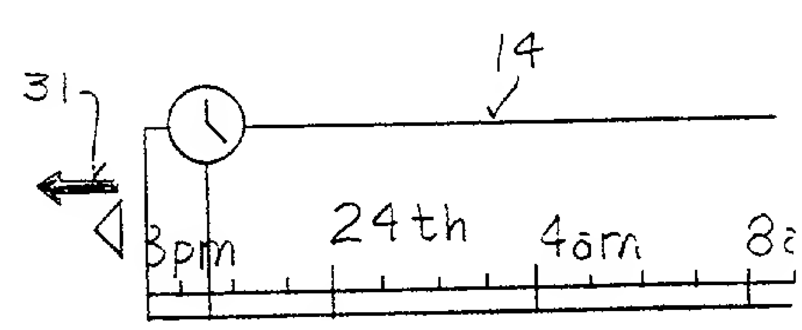
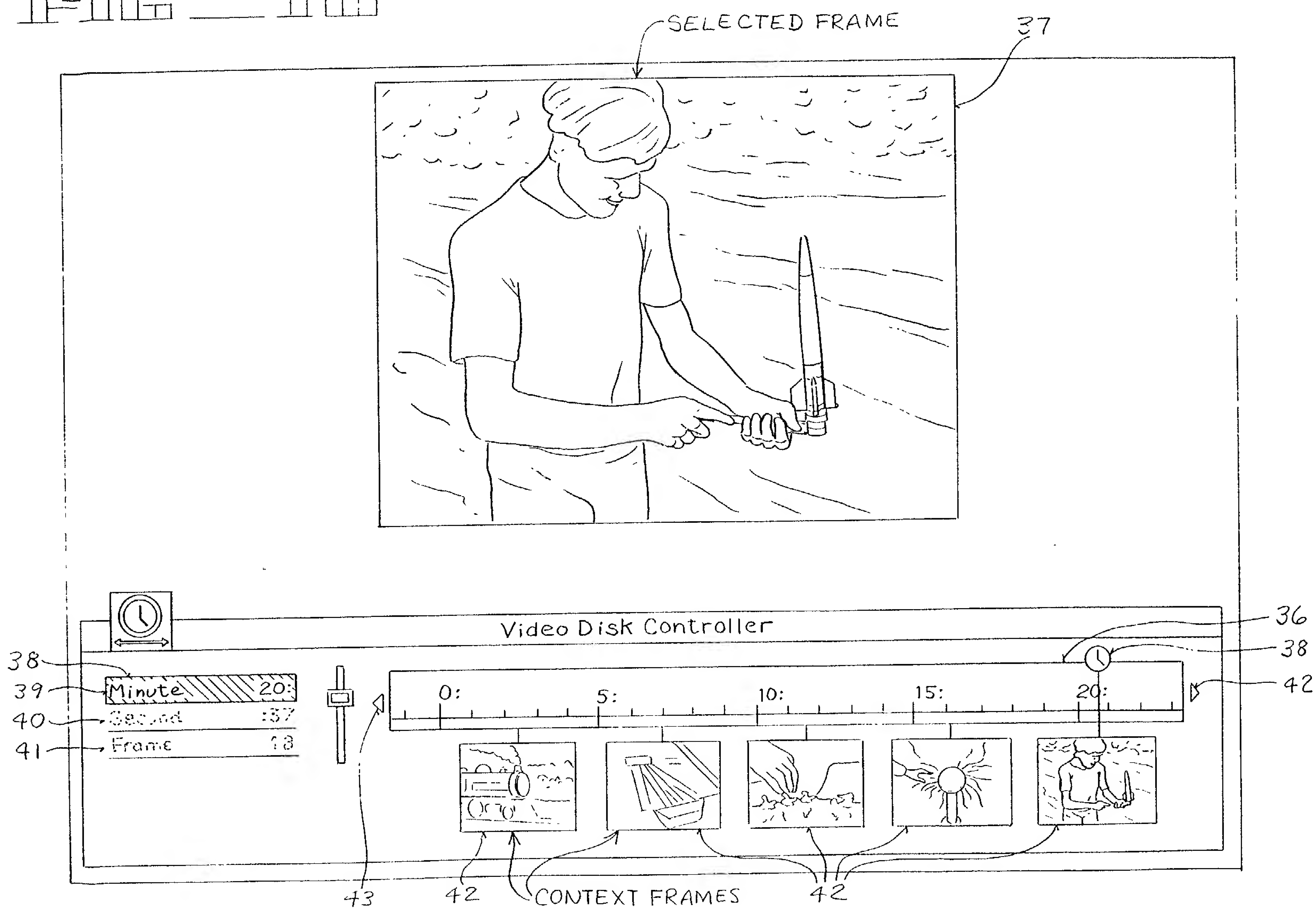
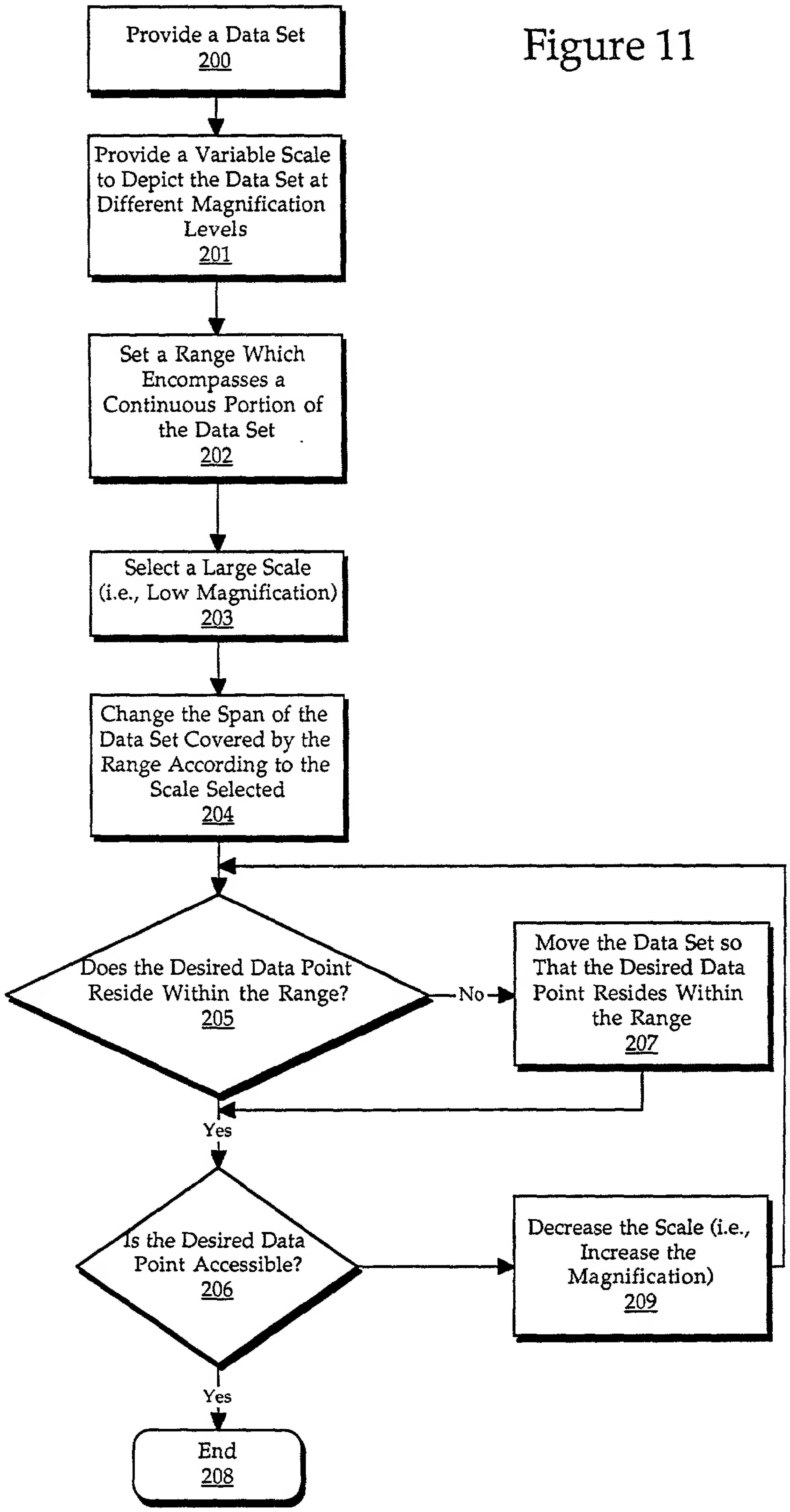


FIG. 10


SELECTED FRAME
37
Video Disk Controller
36
38
38
39
40
41
Minute 20:
Second :37
Frame 18
0:
5:
10:
15:
20:
42
43
42
CONTEXT FRAMES
42



Provide a Data Set
200
Provide a Variable Scale to Depict the Data Set at Different Magnification Levels
201
Set a Range Which Encompasses a Continuous Portion of the Data Set
202
Select a Large Scale (i.e., Low Magnification)
203
Change the Span of the Data Set Covered by the Range According to the Scale Selected
204
Does the Desired Data Point Reside Within the Range?
205
No
Move the Data Set so That the Desired Data Point Resides Within the Range
207
Yes
Is the Desired Data Point Accessible?
206
Decrease the Scale (i.e., Increase the Magnification)
209
Yes
End
208

Figure 11

Attorney's Docket No.: 04860.P539 Patent

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

ZOOMING CONTROLLER

the specification of which

XX is attached hereto.
____ was filed on ________________________ as
Application Serial No. ____________________
and was amended on ____________________.
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the same was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119, of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed	
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No
(Number)	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	Filing Date	(Status -- patented, pending, abandoned)
(Application Serial No.)	Filing Date	(Status -- patented, pending, abandoned)

I hereby appoint Paul A. Apffel, Reg. No. P35,427; Aloysius T. C. AuYeung, Reg. No. P35,432; Bradley J. Bereznak, Reg. No. 33,474; Roger W. Blakely, Jr., Reg. No. 25,831; Jeffrey Jay Blatt, Reg. No. 30,244; Paul Y. Feng, Reg. No. P35,510; Stephen D. Gross, Reg. No. 31,020; David R. Halvorson, Reg. No. 33,395; George W. Hoover, Reg. No. 32,992; Tracy L. Hurt, Reg. No. 34,188; Eric S. Hyman, Reg. No. 30,139; Stephen L. King, Reg. No. 19,180; Maria E. McCormack, Reg. No. 31,639; James D. McFarland, Reg. No. 32,544; George R. Meyer, Reg. No. P35,284; Ronald W. Reagin, Reg. No. 20,340; James H. Salter, Reg. No. P35,668; James C. Scheller, Reg. No. 31,195; Ira M. Siegel, Reg. No. 28,907; Stanley W. Sokoloff, Reg. No. 25,128; Edwin H. Taylor, Reg. No. 25,129; Lester J. Vincent, Reg. No. 31,460; Ben J. Yorks, Reg. No. 33,609; Philip K. Yu, Reg. No. P35,742; and Norman Zafman, Reg. No. 26,250; my attorneys; and Keith G. Askoff, Reg. No. 33,828; and Anthony C. Murabito, Reg. No. P35,295; my patent agents; of BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (310) 207-3800, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole/First Inventor Daniel Scott Venolia

Inventor's Signature D. Scott Venolia Date DECEMBER 20TH 1991

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Inventor's Signature ____________________ Date ____________________

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Full Name of Third/Joint Inventor ____________________

Inventor's Signature ____________________ Date ____________________

Residence ____________________ (City, State) Citizenship ____________________ (Country)

Post Office Address ____________________

Full Name of Fourth/Joint Inventor ____________________

Inventor's Signature ____________________ Date ____________________

Residence ____________________ (City, State) Citizenship ____________________ (Country)

Post Office Address ____________________